

TABLE A31.--Summary of methods used in retrospective studies of tobacco use and cancer of the esophagus (cont.)

Author, year, country, reference	Cases			Controls		
	Sex	Number	Method of selection	Number	Method of selection	Collection of data
Schwartz et al., 1961, France (249).	M.	362	Admissions to hospitals in Paris and a few large provincial cities since 1954.	362	Healthy individuals admitted to same hospital because of work or traffic accidents—matched by 5 year age group and time of admission.	Interviewed by team of specially trained interviewers who interviewed the largest proportion possible of all cancer patients. Cases and matched controls interviewed by same person.
Wynder and Bross, 1961, U.S.A. (310).	M.	150	Cancer patients seen in Memorial Hospital, New York City, and Kingsbridge and Brooklyn VA Hospitals during 1950-59 (86% white).	150	Patients seen in same hospitals during same time period with other tumors. 64%-malignant tumor; 36%-benign conditions. Matched by age with cancer patients.	Data collected by trained interviewers.
	F.	37	Same hospitals and same time period as male patients (86% white).	37	Same as with regard to male controls. 43% had malignant and 57% benign tumors.	
Wynder and Bross, 1961, India (310).	M.	67	Admitted to Tata Memorial Hospital Bombay.	134	Patients with other forms of cancer except for oral cavity and lungs; as well as various benign diseases.	Interviewed by one person. 10% of male and 4% of female cancer cases histologically confirmed.
	F.	27				
Takano et al., 1968, Japan (272).	M.	167	Patients with esophageal cancer.	167	Patients with cancerous and non-cancerous diseases of non-digestive organs.	Interviews at various hospitals. Cases and controls age-matched.
	F.	33		33		

TABLE A31.—*Summary of methods used in retrospective studies of tobacco use and cancer of the esophagus (cont.)*

Author, year, country, reference	Cases			Controls		
	Sex	Number	Method of selection	Number	Method of selection	Collection of data
Bradshaw and Schonland, 1969, South Africa (41).	M.	98	Patients with esophageal cancer.	341	Patients with non-malignant disease.	Hospital interviews by trained African social workers.
Martinez, 1969, Puerto Rico (183).	M.	120	Patients with confirmed epidermoid esophageal cancer diagnosed in 1966.	360	120 male, 59 female patients in same hospital with non-cancerous diagnoses. 240 male, 118 female members from same community.	Interviews by trained personnel.
	F.	59		177		

TABLE A31a.—*Summary of results of retrospective studies of tobacco use and cancer of the esophagus*

Author, year, country, reference		Percent nonsmokers		Percent heavy smokers		Percent inhalers among smokers		Relative risk ratio. All smokers to nonsmokers	
		Cases	Controls	Cases	Controls	Cases	Controls	All smokers	Heavy smokers
Sadowsky et al., 1953, U.S.A. (232).		3.8	13.2	—	—	—	—	4.0	—
Sangvhi et al, 1955, India (241).		5.5	17.3	<i>Average number of bidis smoked</i> 15.3      14.1		—	—	3.6	—
Wynder et al., 1957, Sweden (322).	M F	13.0 (about) 85.0	24.0 (about) 92.0	— —	— —	— —	— —	2.1 2.0	— —
Staszewski, 1960, Poland (260).		—	18.0	95.8	59.0	87.5	80.0	—	—
Schwartz et al., 1961, France (249).		3.0	17.0	<i>Total amount smoked daily (cigarettes)</i> 16.8      16.0		39.0	38.0	6.6	—
Wynder and Bross, 1961, U.S.A. and India (310).	American males American females Indian males Indian females	5.0 41.0 13.0 78.0	15.0 78.0 28.0 94.0	48.0 27.0 — —	33.0 16.0 — —	— — — —	— — — —	3.4 5.1 2.6 4.5	4.4 3.2 — —
Takano et al., 1968, Japan (272).		17.0	23.0	—	—	—	—	1.3	—
Bradshaw and Schonland, 1969, South Africa (41).		15.3	31.7	31.6	5.9	—	—	2.6	11.1
Martinez, 1969, Puerto Rico (183).		14.0	23.5	17.9	8.6	—	—	1.8	3.5

TABLE A32.—*Atypical nuclei in basal cells of epithelium of esophagus of males, by smoking habits and age*

Atypical nuclei	Never smoked regularly		Current Cigarettes		Ex-cigarettes		Pipe, cigar		Other	
	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
<b>A. All men:</b>										
Number men . . . . .	91	—	779	—	181	—	89	—	62	—
Total sections <sup>1</sup> . . . . .	787	100.0	6,752	100.0	1,586	100.0	766	100.0	522	100.0
No atypical nuclei . . . . .	733	93.1	167	2.5	770	48.5	53	6.9	195	37.4
Some but <60 percent atypical . . . . .	52	6.6	5,389	79.8	765	48.3	688	89.8	317	60.7
60 percent or more atypical . . . . .	2	0.3	1,196	17.7	51	3.2	25	3.3	10	1.9
<b>B. Men under age 50:</b>										
Number men . . . . .	26	—	236	—	28	—	9	—	7	—
Total sections . . . . .	223	100.0	2,059	100.0	258	100.0	77	100.0	53	100.0
No atypical nuclei . . . . .	190	85.2	71	3.4	56	21.7	1	1.3	4	7.5
Some but <60 percent atypical . . . . .	33	14.8	1,853	90.0	195	75.6	74	96.1	46	86.8
60 percent or more atypical . . . . .	—	—	135	6.6	7	2.7	2	2.6	3	5.7
<b>C. Men aged 50-69:</b>										
Number men . . . . .	44	—	445	—	109	—	38	—	31	—
Total sections . . . . .	379	100.0	3,853	100.0	953	100.0	310	100.0	256	100.0
No atypical nuclei . . . . .	373	98.4	83	2.2	461	48.4	37	11.9	74	28.9
Some but <60 percent atypical . . . . .	4	1.1	2,915	75.6	452	47.4	261	84.2	178	69.5
60 percent or more atypical . . . . .	2	0.5	855	22.2	40	4.2	12	3.9	4	1.6
<b>D. Men aged 70 or older:</b>										
Number men . . . . .	21	—	98	—	44	—	42	—	24	—
Total sections . . . . .	185	100.0	840	100.0	375	100.0	379	100.0	213	100.0
No atypical nuclei . . . . .	170	91.9	13	1.5	253	67.4	15	4.0	117	54.9
Some but <60 percent atypical . . . . .	15	8.1	621	74.0	118	31.5	353	93.1	98	43.7
60 percent or more atypical . . . . .	—	—	206	24.5	4	1.1	11	2.9	3	1.4

<sup>1</sup> Sections with some epithelium present.

Source: Auerbach, O. et al. (15).

TABLE A33.—*Atypical nuclei in basal cells of epithelium of esophagus of males, by amount of smoking and age*

Cells with atypical nuclei	Current cigarette smokers							
	Never smoked regularly		<1 pack		1-2 packs		>2 packs	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
A. All ages	91	...	179	...	413	—	187	—
Total sections <sup>1</sup>	787	100.0	1,544	100.0	3,629	100.0	1,579	100.0
No atypical nuclei	733	93.1	89	5.8	39	1.1	39	2.5
Some but <60 percent atypical	52	6.6	1,341	86.8	2,957	81.5	1,091	69.1
60 percent or more atypical	2	0.3	114	7.4	633	17.4	449	28.4
B. Men under age 50:								
Number men	26	...	9	—	132	—	55	—
Total sections <sup>1</sup>	223	100.0	433	100.0	1,169	100.0	457	100.0
No atypical nuclei	190	85.2	48	11.1	21	1.8	2	0.4
Some but <60 percent atypical	33	14.8	382	88.2	1,089	93.2	382	83.6
60 percent or more atypical	...	...	3	0.7	59	5.0	73	16.0
C. Men aged 50-69:								
Number men	44	...	92	—	240	—	113	—
Total sections <sup>1</sup>	379	100.0	789	100.0	2,116	100.0	948	100.0
No atypical nuclei	373	98.4	30	3.8	18	0.9	35	3.7
Some but <60 percent atypical	4	1.1	694	87.9	1,607	75.9	614	64.8
60 percent or more atypical	2	0.5	65	8.3	491	23.2	299	31.5
D. Men aged 70 or older:								
Number men	21	...	38	—	41	—	19	—
Total sections <sup>1</sup>	185	100.0	322	100.0	344	100.0	174	100.0
No atypical nuclei	170	91.9	11	3.4	—	—	2	1.1
Some but <60 percent atypical	15	8.1	265	82.3	261	75.9	95	54.7
60 percent or more atypical	...	...	46	14.3	83	24.1	77	44.2

<sup>1</sup> Sections with some epithelium present.

Source: Auerbach, O. et al. (15).

TABLE A35.—Summary of methods used in retrospective studies of smoking and cancer of the bladder

Author, year, country, reference	Cases			Controls	
	Sex	Number	Method of selection	Number	Method of selection
Lilienfeld et al., 1956, U.S.A. (171).	M.	321	Admissions to Roswell Park Memorial Institute. 1945-55 over 45 years of age.	337	No disease patients.
	F.	116	Same as males	109 317	Benign bladder conditions. No disease patients.
Schwartz et al., 1961, France (249).	M.	214	Admissions to hospitals in Paris and a few large provincial cities since 1954.	214	Healthy individuals admitted to same hospital because of work or traffic accident, matched by 5 year age group.
Lockwood, 1961, Denmark (175).	M.	282	All bladder tumors reported to Danish Cancer Register during 1942-56 and living at time of interview in Copenhagen and Fredericks- burg. (Includes bladder papillomas).	282	A. From election rolls matched with cases ac- cording to sex, age, marital status, occupa- tion, and residence. B. Another control group obtained from sam- ple of Danish Morbidity Survey (1952, 1953, and 1954) compared with respect to smok- ing histories.
	F.	87		87	
Wynder, 1963, U.S.A. (326).	M.	200	First phase:	200	Admission to same hospitals (excluded cancer of respiratory system, upper alimentary tract, myocardial infarction) matched by sex and age. Same as above.
	F.	50	Admission to several hospitals in New York City during January 1957-Decem- ber 1960.	50	
	M.	100	Second phase:	100	
	F.	20	Admission to same hospitals during 1961.	20	
Cobb and Ansell, 1965, U.S.A. (57).	M.	136	Patients admitted to VA Hospital in Seattle 1951-61.	342	120 patients with cancer of sigmoid colon, 222 patients with non-neoplastic pulmonary dis- ease.

TABLE A35.—*Summary of methods used in retrospective studies of smoking and cancer of the bladder (cont.)*

Author, year, country, reference	Cases			Controls	
	Sex	Number	Method of selection	Number	Method of selection
Staszewski, 1966, Poland (261).	M.	150	Patients with histologically confirmed bladder carcinoma.	750	Undefined source age-matched.
Deeley and Cohen, 1966, England (66).	M.	127	Patients with histologically confirmed bladder carcinoma.	127	Patients in same hospital with non-cancerous or pulmonary disease matched for age.
Yoshida et al., 1968, Japan (330).	M.	163	Patients with bladder cancer.	163	"Comparison cases."
	F.	29		59	
Kida et al., 1968, Japan (144).	M.	88	Admissions to 15 hospitals in North Fukuoka prefecture.	88	Selected from patients hospitalized in same region for non-urinary ailments and age-matched
	F.	26		26	
Dunham et al., 1968, U.S.A. (85).	M.	334	Admissions to New Orleans hospitals with histologic diagnosis of bladder carcinoma.	350	Admissions to same hospitals with non-neoplastic diseases and diseases unrelated to genitourinary tract.
	F.	159		177	
Anthony and Thomas, 1970, England (3).	M.	381	Patients with papilloma and cancer of bladder at Leeds between 1958-67.	275	Surgical patients without cancer previously interviewed for lung cancer study.

TABLE A35a.—Summary of results of retrospective studies of smoking and cancer of the bladder

Author, year, country, reference	Sex	Percent nonsmokers		Percent heavy smokers		Percent cigarettes smoked		Relative risk ratio: All smokers to nonsmokers			Comments
		Cases	Controls	Cases	Controls	Cases	Controls	All smokers	Heavy smokers	Cigarette smokers	
Lilienfeld et al., 1956, U.S.A. (171).	M.	15.0	29.0	...	...	61.0	44.0	2.3	...	2.7	Cigarette and other.
	F.	87.0	83.0	...	...	...	...	1.4	...	...	
Schwartz et al., 1961, France (249).	M.	11.0	20.0	...	...	83.0	70.0	2	...	2.2	Cigarette only.
Lockwood, 1961, Denmark (175).	M.	9.0	13.4	30.0	15.0	30.0	15.0	1.6	3.0	3.0	Cigarettes main mode of smoking.
	F.	56.0	66.0	4.0	4.0	...	...	1.5	1.2	...	
Wynder et al., 1963, U.S.A. (326).	M.	7.0	18.0	47.0	23.0	85.0	63.0	2.9	5.2	3.3	Phases A and B com- bined.
	F.	61.0	86.0	6.0	...	...	...	3.9	...	...	
Cobb and Ansell, 1965, U.S.A. (57).	M.	4.6	25.8	79.4	43.3	...	...	7.3	10.3	...	
Staszewski, 1966, Poland (261).	M.	6.7	16.0	85.7	65.7	87.1	72.2	2.7	3.1	2.9	Cigarettes only.
Deeley and Cohen, 1966, England (66).	M.	2.4	7.1	...	...	...	...	3.1	...	...	

TABLE A35a.—*Summary of results of retrospective studies of smoking and cancer of the bladder (cont.)*

Author, year, country, reference	Sex	Percent nonsmokers		Percent heavy smokers		Percent cigarettes smoked		Relative risk ratio: All smokers to nonsmokers			Comments
		Cases	Controls	Cases	Controls	Cases	Controls	All smokers	Heavy smokers	Cigarette smokers	
Yoshida et al., 1968, Japan (330).	M.	8.0	22.7	43.4	33.0	—	—	3.4	3.7	—	
	F.	62.1	86.4	—	—	—	—	—	—	—	
Kida et al., 1968, Japan (144).	M.	11.0	11.0	32.0	29.0	—	—	1.0	—	—	
	F.	16.0	21.0	—	—	—	—	1.4	—	—	
Dunham et al., 1968, U.S.A. (85).	M.	8.6	14.5	—	—	49.4	45.4	1.8	—	1.8	Cigarettes only.
	F.	62.2	61.5	—	—	32.0	28.2	1.0	—	1.1	
Anthony and Thomas, 1970, England (3).	F.	6.3	6.3	—	—	36.5	29.1	1.0	—	1.3	Cigarettes only. More than 15 a day.

## CHAPTER 5

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### Pregnancy

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## INTRODUCTION

In recent years, there has been increased research on environmental factors which may adversely affect the unborn child. The potential effect of maternal smoking on the fetus has been of particular interest because of the large number of pregnant women who smoke and because smoking is an environmental influence which could be controlled. Based on 1970 surveys of smoking habits in representative samples of the U.S. population, it is estimated that one-third of American women in the child-bearing age group of 15 to 44 years are cigarette smokers. What proportion of these give up smoking or cut down substantially on their smoking during pregnancy is not known.

## EFFECT ON BIRTHWEIGHT

Epidemiological and experimental studies have supported the view that maternal smoking during pregnancy exerts a retarding influence on fetal growth (tables 2, 6). Analysis of over 100,000 births shows that the infants of mothers who smoke during pregnancy have a mean birthweight of 6.1 ounces less than the infants born to nonsmoking mothers (table 2). Several studies have documented that this effect is independent of other factors known to exert a negative influence on infant birthweight, such as elevated maternal blood pressure and small maternal size (1, 36, 39). The reduction in infant birthweight is greater among heavy smoking mothers than light smoking mothers (12, 21, 23, 30, 41, 50, 58), and has been found in pregnancies terminating in each trimester (12, 16, 23, 40, 51, 54). In a study of more than 48,000 women, Underwood, et al. (51) demonstrated that infants born to women who smoked during part of their pregnancy were significantly smaller than infants born to nonsmokers, and that infants born to women who smoked throughout their pregnancy were significantly smaller than the infants born to women who smoked during part of their pregnancy. Russell, et al. (39) have presented evidence that although infants born to smoking mothers weighed less than those of nonsmoking mothers, they grew more rapidly during the first six months of life. At one year of age, children born to smoking mothers weighed nearly the same as those born to nonsmoking mothers. They concluded that smoking exerts a retarding influence

on fetal growth and that after delivery this is largely compensated for by a period of more rapid growth.

As documented in more than 15 prospective and retrospective studies, smoking mothers have significantly more infants who are premature, as defined by weight alone ( $<2,500$ ) grams, than do non-smoking mothers (table 3). Buncher (4) studied the mean duration of pregnancy in smokers and nonsmokers in a survey which included 49,897 live births. He found that women smoking 20 cigarettes a day had a mean length of gestation which was approximately one day shorter than that of nonsmoking women. He calculated that this shortening of gestation is enough to account for only 10 percent of the known reduction in birthweight that is associated with maternal smoking.

#### EFFECT ON OUTCOME OF PREGNANCY

Some controversy has surrounded the question of whether maternal smoking during pregnancy is associated with an increased risk of spontaneous abortion, stillbirth, and neonatal death. Table 4 summarizes the studies which have dealt with this question. Some of the studies did not demonstrate such an increased risk (7, 34, 50, 51), while others did (12, 23, 33, 58). Many of these reports (7, 23, 33, 34, 41, 49, 58) were based on retrospective studies and included women delivering their infants in hospitals and infants whose names appeared on listings of newborn children (table 1). As Russell, et al. (39) have pointed out, such studies may be subject to selective bias since they tend to underrepresent women who have aborted. These retrospective studies also did not systematically control for maternal social class, parity, and maternal age, all of which are related to the outcome of pregnancy and also are related to smoking in some populations. In a prospective study of more than 2,000 pregnant women, Russell, et al. (39) have demonstrated a significantly higher percentage of unsuccessful pregnancies (that is, abortion, stillbirth, or neonatal death) among women who smoked during their pregnancy than among those who did not. He interpreted his findings to mean that 20 percent of "... unsuccessful pregnancies in women who smoke regularly would have been successful if the mother had not been a regular smoker" (38).

The Second Report of the 1958 British Perinatal Mortality Survey published in 1969 is one of the largest prospective studies to deal with this question (5). It included 98 percent of the total births registered during one week in March 1958 throughout England, Scotland, and Wales. In this study, a large amount of obstetric and sociobiologic information was obtained on 17,000 singleton births. This study reported that "the mortality in babies of smokers was significantly higher than in those of nonsmokers." The increase in

TABLE 1.—*Summary of methods used in study of smoking and human pregnancy*

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
Simpson, 1957, U.S.A. (44).	R.	7,499	Questionnaire was filled out 48 hours after delivery for all patients at San Bernardino County Hospital for 3 years. Same form used for 2 years at St. Bernardines Hospital and Loma Linda Hospital.	Multiple births excluded.	The county hospital population was different, with 50.6 per cent of the births being "Mexican".
Lowe, 1959, England (23).	R.	2,042	Questionnaire was filled out for every woman delivering at one of six Birmingham hospitals over a 5-month period.	Non-Europeans and women with twin births were excluded.	Social workers performed interviews.
Frazier et al., 1961, U.S.A. (12).	P.	2,736	(a) Interview. (b) Prenatal clinic history. (c) Birth and stillbirth certificates.	All Negro women seen at Baltimore Maternity Interviewing Service in 1959 who were scheduled for delivery at Baltimore City Hospital and who received prenatal care in clinic of Baltimore City Health Department.	Nonsmokers include occasional smokers.
Herriot et al., 1962, Scotland (16).	R.	2,745	Questionnaire filled out for Aberdeen city residents who were delivered in Aberdeen City Hospital over a 1-year period.		
Savel and Roth, 1962, U.S.A. (41).	R.	1,415	1,500 consecutive patients admitted to Newark Beth Israel Hospital were interviewed.	Included were private and ward patients, Negro and white patients, primigravidas, and multiparas; Cesarean sections, elective inductions, and multiple pregnancies were excluded.	Women were considered smokers even if they smoked only 1 cigarette per day.

TABLE 1.—*Summary of methods used in study of smoking and human pregnancy (cont.)*

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
Yerushalmy, 1962, U.S.A. (53).	P.	982	Form questionnaire.	Pregnancies terminating in abortion were excluded.	
Murdoch, 1963, U.S.A. (50).	R.	500	Personal interview by author.	All mothers delivering at Nebraska Methodist Hospital from Septem- ber 1962 to January 1963.	
O'Lane, 1963, U.S.A. (53).	R.	1,031	Standard U.S. Naval Obstetrical Code Sheet was used with supplemental questions. Additional information was obtained from prenatal his- tory.	1,031 Caucasian women who had single pregnancies delivered va- ginally over a 6-month period.	"Smokers" defined as those smoking regularly each day.
Zabriskie, 1963, U.S.A. (58).	R.	2,000	History was obtained during the postpartum period from 2,000 con- secutive births over a 6-month period.	Twin deliveries were omitted.	
Yerushalmy, 1964, U.S.A. (54).	P.	6,800	Personal interview.	All women were members of Kaiser Foundation Health Plan. Only pregnancies terminating in single, live births included. All races ex- cept whites and Negroes were ex- cluded.	5,381 whites 1,419 Negroes.
MacMahon et al., 1965, U.S.A. (24).	R.	12,192	Mail questionnaire.	Mothers of single, white, legitimate live births. Mothers were residents of Massachusetts and delivered in May or June of 1963.	Birthweight based on birth certificate.

TABLE 1.—*Summary of methods used in study of smoking and human pregnancy (cont.)*

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
McDonald and Lanford, 1965, U.S.A. (26).	P.	177	Interview.	White, unmarried primigravidas receiving obstetric care over a 2-year period.	
Peterson et al., 1965, U.S.A. (34).	R.	7,740	Cooperative study involving 17 hospitals in 13 states, using U.S. Air Force obstetrical code.	Includes only those multiparas whose prior infants weighed >2,500 grams (Caucasians). All pregnancies with any complication were excluded. Cesarean sections and induced delivery were excluded.	
Robinson, 1965, Burma (37).	P.	1,614	Interview.	Regular attendees at prenatal clinic.	46.8 percent of women smoked cheroots.
Underwood et al., 1965, U.S.A. (50).	R.	4,440	Interview by obstetrical resident. Data was obtained on 16,158 pregnancies from the 4,440 women.	Puerperal women from Roper Hospital and Medical College Hospital. Only infants weighing >1,000 grams were included.	Women from Roper Hospital were of above average economic status. Women from Medical College Hospital included Negro and white patients.
Downing and Chapman, 1966, U.S.A. (7).	R.	5,659	Review of clinic records from 1952 to 1958.	Six-year total of obstetrical patients at clinic.	

TABLE 1.—*Summary of methods used in study of smoking and human pregnancy (cont.)*

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
Ravenholt et al., 1966, U.S.A. (35).	R.	2,023	Epidemiologic questionnaire. Much data collected over telephone. Additional data obtained from birth certificates.	Study population was identified by the listing of newborn infants in a Seattle newspaper during May, June, and July of 1964. Twins were excluded.	95.4 percent of mothers were white.
Reinke and Henderson 1966, U.S.A. (36).	R.	3,156	Registration data of prenatal clinic.	Negro women who delivered single, live infants from 1962-64.	
Kizer, 1967, Venezuela (19).		2,095	Interview.	Patients receiving care at "concepcion palacias" in Caracas.	
Underwood et al., 1967, U.S.A. (51).	P.	48,505	Code sheets submitted from 44 world-wide naval installations. Code sheets were completed by the attending physician upon the mother's admission to the labor room.	Women with single pregnancies delivered of infants weighing more than 500 grams between July 1, 1963, and June 30, 1965.	
Duffus and MacGillivray, 1968, Scotland, (8).	R.	2,543	Antenatalclinic records.	All "booked" married city primigravidae attending the antenatal clinics during 1960, 1964, and 1965.	The number of cigarettes smoked was not considered.
Mulcahy and Knaggs, 1968, Ireland (28).	R.	3,681	Hospital record review.	Mothers admitted to the Coombe Hospital from April 1963 to October 1964.	

TABLE 1.—Summary of methods used in study of smoking and human pregnancy (cont.)

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
Russell et al., 1968, England (39).	P.	2,110	Data collected by Senior research midwives over a 4- to 5-year period.	Women attending the two main maternity units in Sheffield, who "comprised a reasonably representative sample." Multiple pregnancies were omitted.	Included some threatened abortions and some with "bad" obstetrical histories.
Tokuhata, 1968, U.S.A. (49).	R.	2,016	Personal interview or mail questionnaire of surviving family members.	Women selected from Memphis and Shelby County death registry who died of cancer of genitalia or breast since 1950 and who had been married.	Control group taken from same registry. They died of causes other than cancer and were matched for race, age at death, and year of death.
Buncher, 1969, U.S.A. (4).	R.	49,897	Data obtained from U.S. Navy obstetrical study from 1963 to 1965. Smoking data obtained by physician at the time of mother's admission to labor room.	Women with single pregnancies delivered of infants weighing more than 500 grams between July 1, 1963, and June 30, 1965.	Includes cases reported by Underwood et al. (47) in 1967.
Butler and Alberman, 1969, Great Britain (5).	P.	17,000	The British Perinatal Mortality Survey of 1958 when a large amount of obstetric and sociobiologic information was obtained from birth attendants, records, and at interview with the mothers.	98 percent of the total births registered during 1 week in March 1958 throughout England, Scotland, and Wales.	Another 7,000 perinatal deaths were surveyed by identical methods over a 3-month period.
Terris and Gold, 1969, U.S.A. (47).	R.	197	Public Health Nurse interviewed each mother on first or second postpartum day.	Premature Negro ward births (<2,500 grams) with no known cause of prematurity. Controls were matched by sex, birth order of infant, age, and marital status of the mother.	

TABLE 1.—*Summary of methods used in study of smoking and human pregnancy (cont.)*

Author, year, country, reference	Retrospective or prospective	Number of persons	Data collection	Case selection	Comments
Mulcahy et al., 1970, Ireland (29).	P.	100	Interview by physician.	100 mothers of term infants who were free from all significant medical and obstetrical complications. All were between 20 and 30 years of age and were Para III or less. All had normal deliveries. Half were smokers of 10 or more cigarettes per day.	

TABLE 2.—*Maternal smoking and infant weight*  
(Numbers in parentheses indicate absolute number of infants in respective groups)

Author, reference	Infant weight		Difference in mean weight of infant of smoker versus nonsmoker		Comments
	Nonsmoker	Smoker			
Lowe (23)		<10 cigarettes per day	>10 cigarettes per day		Effect on infant weight was independent of maternal age, parity, or complica- tions of pregnancy.
	Male . . . . .	7.43 lbs. (607)	7.18 (187)	7.05 (165)	
	Female . . . . .	7.23 lbs. (539)	6.74 (163)	6.67 (147)	
	Total . . . . .	7.33 lbs. (1,146)	6.98 (350)	6.87 (312) 170 g. (6 oz.)	
Frazier et al., (12).	3,080 g. (1,717)		2,924 g. (1,019)	156 g. (5.5 oz.)	Nonsmokers include occasional smokers.
Herriot et al., (16).	No data . . . . . (1,473)		No data (1,272)	160 g. (5.6 oz.)	Effect on infant weight was independ- ent of maternal age, parity, height, or social class.
Savel and Roth (41).	White . . . . .	3,374 g. (383)	3,141 g. (428)	233 g. (8.2 oz.)	<i>Cigarettes per day</i> <i>Infant weight</i> White smokers: 1-10 . . . . . 3,210 g. (161) 11-20 . . . . . 3,198 g. (184) >20 . . . . . 3,010 g. (83) Negro smokers: 1-10 . . . . . 3,042 g. (169) 11-20 . . . . . 3,012 g. (57) >20 . . . . . 2,968 g. (14)
	Negro . . . . .	3,173 g. (364)	3,031 g. (240)	142 g. (5.0 oz.)	
Murdoch (30).	7 lbs. 7.5 oz. (242)		6 lbs. 15 oz. (258)	8.5 oz.	
O' Lane (33).	2,978 g. (566)		2,938 g. (465)	40 g. (1.4 oz.)	

TABLE 2.—*Maternal smoking and infant weight (cont.)*  
(Numbers in parentheses indicate absolute number of infants in respective groups)

Author, reference	Infant weight		Difference in mean weight of infant of smoker versus nonsmoker		Comments
	Nonsmoker	Smoker			
Zabriskie (58).	3,320 g. (1,043)	3,091 g. (957)	229 g. (8.1 oz.)		<i>Cigarettes per day</i> <i>Infant weight</i> <10 ..... 3,205 g. (260) 10-20 ..... 3,090 g. (395) 20-30 ..... 2,970 g. (264) >30 ..... 3,190 g. (38)
MacMahon et al., (24).	Male ..... 124.0 oz. (3,053) Female ..... 119.9 oz. (2,906)	116.3 oz. (3,173) 111.9 oz. (3,011)	7.7 oz. 8.0 oz.		<i>Cigarettes per day</i> <i>Infant weight (ounces)</i> Male      Female <10 . 121.2 (658) 116.6 (595) 10-20 . 115.2 (1,262) 112.2 (1,259) 20-40 . 114.6 (1,165) 108.9 (1,088) >40 . 113.2 (66) 111.7 (49)
McDonald and Lanford (26).	111.68 oz. (87)	<i>Light smoker</i> 110.83 oz. (42) <i>Heavy smoker</i> 109.38 oz. (48)	No significant difference between mean birthweights.		
Underwood et al., (50).	Group: I ..... 3,522 g. (2,406)  II ..... 3,304 g. (557)  III ..... 3,126 g. (7,775)	<i>Cigarettes per day</i> <10 ..... 3,349 g. 10-20 ..... 3,236 g. † (1,720) >20 ..... 3,169 g. <10 ..... 3,171 g. 10-20 ..... 3,146 g. † (660) >20 ..... 3,092 g. <10 ..... 2,938 g. 10-20 ..... 2,965 g. † (3,040) >20 ..... 3,011 g.	For >20 cigarettes per day 353 g. (12.5 oz.) (p<0.001)  212 g. (7.5 oz.) (p<0.001)  115 g. (4.1 oz.) (p<0.001)		Patients were divided into 3 groups: I....Private patients of above average economic status. II....White patients of average economic status. III....Negro patients of low economic status. † Total for all smokers in each group.
Ravenholt et al., (35).	Male ..... 7.80 lbs. (171) Female ..... 7.50 lbs. (150)	7.21 lbs. † (167) 7.05 lbs. † (171)	.59 lbs. (9.4 oz.) .45 lbs. (7.2 oz.)		† Smoked >4,000 cigarettes during pregnancy.

TABLE 2.—*Maternal smoking and infant weight (cont.)*  
(Numbers in parentheses indicate absolute number of infants in respective groups)

Author, reference	Infant weight		Difference in mean weight of infant of smoker versus nonsmoker	Comments
	Nonsmoker	Smoker		
Reinke and Henderson (56).	3,135 g. (1,542)	2,987 g. (1,614)	148 g. (5.2 oz.) (p<0.001)	
Kizer (19).	Data not available	Data not available	97 g. (3.4 oz.)	Total number of patients—2,095.
Underwood et al., (51).	3,395 g. (24,865)	<i>Cigarettes per day</i> 1-10 ..... 3,286 g. (7,609) 11-30 ..... 3,196 g. (14,450) >30 ..... 3,182 g. (1,570)	109 g. (3.8 oz.) 199 g. (7.0 oz.) 213 g. (7.5 oz.)	
Mulcahy and Knaggs (28).	113.3 oz.	<i>Cigarettes per day</i> 1- 4 ..... 111.4 oz. 5- 9 ..... 102.3 oz. 10-14 ..... 102.0 oz. 15-19 ..... 102.9 oz. >20 ..... 102.4 oz.	1.9 oz. 11.0 oz. 11.3 oz. 10.4 oz. 10.9 oz.	
Russell et al., (59).	BP <140/ 90 117.2 ± .7 oz. (984) 140/ 90 114.2 ± 1.2 oz. (340) >150/100 99.8 ± 2.6 oz. (138)	107.2 ± 1.0 oz. (496) 108.9 ± 2.4 oz. (117) 90.8 ± 5.8 oz. (35)	10.0 oz. 5.3 oz. 8.5 oz.	The effect of maternal smoking on fetal weight was independent of maternal parity, age, height, educational level, attitude to pregnancy or work during pregnancy, father's social class, consort's social class, and sex of the child or premature delivery.
Butler and Alberman (5).	3,375 g. (11,145)	3,205 g. (4,660)	170 g. (6 oz.)	Reduction of mean birthweight of babies born to smokers was independent of unduly high proportion of babies born preterm, and maternal factors including social class and maternal height.
Mulcahy et al., (29).	3.83 kg. (50)	3.43 kg. (50)	396 g. (14 oz.)	

TABLE 3.—*Maternal smoking and prematurity (cont.)*  
(Figures in parentheses are the absolute number of premature births)

Author, reference	Premature by		Percent of premature infants				Mean duration of pregnancy		Comments	
	Weight	Duration of gestation	Nonsmokers		Smokers		Nonsmokers	Smokers		
Simpson (44).	<2,500 g.	Name of hospital:	County	7.77	(144)	11.48	(96)			Number and percent of premature infants: Nonsmokers . . . . 6.39 (328) Cigarettes per day: 1-5 . . . . . 7.06 (47) 6-10 . . . . . 11.18 (89) 11-15 . . . . . 11.36 (31) 16-20 . . . . . 13.6 (77) 21-30 . . . . . 25.0 (11) >30 . . . . . 33.3 (9)
			Loma Linda	6.16	(86)	12.13	(49)			
			St. Bernardines	5.21	(98)	10.50	(119)			
Lowe (28).	<260 days		6.4	(57)	10.6	(58)	279.9 days	278.5 days	At each week of gestation, the mean birthweight was lower in babies of smokers.	
Frazier et al., (12).	<2,500 g.		11.2	(175)	18.6	(179)	38.7 weeks	38.4 weeks	Infants of smokers weighed less than infants of nonsmokers for a wide range of preg- nancy duration.	
Herriot et al., (16).	No data	No data	Social class:						2,745 patients in the study. At each week of gestation, the mean birthweight was lower in babies of smokers.	
			I and II	4.0	4.8					
			III	3.5	6.8					
			IV and V	6.3	12.6					
Savel and Roth (41).	36 weeks	White	2.6	(10)	4.9	(21)	White	.39.8	39.4	† Premature by weight but ma- ture by date (>37 weeks).
		Negro	13.7	(50)	11.3	(27)	Negro	.38.8	38.8	
	†<2,500 g.	White	1.8	(7)	3.7	(16)				
		Negro	3.6	(13)	8.3	(20)				